DISPLAY DEVICE AND SMART WATCH

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This U.S. non-provisional patent application claims priority under 35 U.S.C. §119 of Korean Patent Application No. 10-2015-0133411, filed on Sep. 21, 2015, the contents of which are hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Field

[0003] The described technology generally relates to a display device and a smart watch.

[0004] Description of the Related Technology

[0005] Various multimedia devices, such as a television set, a mobile phone, a navigation system, a computer monitor, a game machine, etc., include display devices. In recent years, a curved or folded display device (hereinafter, referred to as a flexible display device) has been developed in accordance with increasing market demand. The flexible display device includes a flexible display panel and various functional members including diving circuitry to transfer image data to the display pixels.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

[0006] One inventive aspect relates to a flexible display device.

[0007] Another aspect is a display device including a front display panel displaying a front image to a front direction and having a round edge when viewed from the front direction, a side display panel displaying a side image to a side direction different from the front direction and curved to face the edge when viewed from the front direction, and a driving board connected to the front display panel and the side display panel and applying first and second signals to the front display panel and the side display panel, respectively.

[0008] The front display panel includes a front display surface substantially vertical to the front direction and the side display panel includes a side display surface substantially vertical to the side direction.

[0009] The side display surface is curved along the edge.

[0010] The driving board includes a driving chip generating the first and second signals.

[0011] The display device further includes a first conductive film connecting the driving chip and the front display panel and a second conductive film connecting the driving chip and an one end of the side display panel.

[0012] The driving chip includes a plurality of first pins connected to the first conductive film and a plurality of second pins connected to the second conductive film.

[0013] The driving chip includes a first side substantially parallel to a first direction and a second side substantially parallel to a second direction, the first pins are disposed at the first side, and the second pins are disposed at the second side.

[0014] The driving board includes a plurality of first fan-out lines and a plurality of second fan-out lines, one ends of the first fan-out lines are respectively connected to the first pins, the other ends of the first fan-out lines are connected to the first conductive film, one ends of the second fan-out lines are respectively connected to the second pins, and the other ends of the second fan-out lines are connected to the second conductive film.

[0015] The driving board includes a plurality of third fan-out lines, the driving chip includes a plurality of third pins disposed at the first side, one ends of the third fan-out lines are respectively connected to the third pins, and the other ends of the third fan-out lines are connected to the second conductive film.

[0016] The first fan-out lines are arranged in the first direction and the second fan-out lines are arranged in the second direction.

[0017] When viewed from the front direction, the side display panel surrounds the front display panel, the one end of the side display panel is disposed adjacent to one end of the driving board in the first direction, and the other end of the side display panel is disposed adjacent to the other end of the driving board in a third direction opposite to the first direction.

[0018] The display device further includes a third conductive film to connect the driving chip and the other end of the side display panel.

[0019] The driving chip includes a plurality of fourth pins connected to the third conductive film.

[0020] The driving chip includes a third side substantially parallel to the second direction and disposed adjacent to the second side in the third direction, and the fourth pins are disposed at the third side.

[0021] The second signal includes a first side signal applied to a first area of the side display panel and a second side signal applied to a second area of the side display panel, the second pins output the first side signal, and the fourth pins output the second side signal.

[0022] The first area is defined adjacent to the second area in the second direction.

[0023] The second area is defined adjacent to the first area in the third direction.

[0024] The first signal includes a first data voltage used to display the front image and the second signal includes a second data voltage used to display the side image.

[0025] The first signal includes a first gate signal to turn on transistors of pixel circuits included in the front display panel and the second signal includes a second gate signal to turn on transistors of pixel circuits included in the side display panel.

[0026] The display device further includes a body portion including an upper surface substantially vertical to the front direction and a side surface substantially vertical to the side direction. The front display panel is coupled to the upper surface of the body portion and the side display panel is coupled to the side surface of the body portion.

[0027] The front display panel has substantially a circular plate shape and the side display panel is curved to surround a circumference of the display panel.

[0028] The front direction is substantially vertical to the side direction.

[0029] Another aspect is a display device comprising: a front display panel configured to display a front image in a front direction and having an edge at the perimeter that is curved; a side display panel that is curved and configured to display a side image in a side direction conforming to the edge of the front display panel; and a driver circuit board connected to the front and side display panels and config-